Worksheet 2 Writing and following algorithms Answers

Task 1

1. What will be the output from the algorithm below if the user inputs “Hi, Jo!” Explain briefly the purpose of the algorithm.

```
function encrypt(message, shift)
  message = lowercase(message)
  encryptedMessage = ""
  for x in message
     if x in “abcdefghijklmnopqrstuvwxyz”
        num = ord(x)            # convert to ASCII value
        num = num + shift
        if num > ord(“z”)       # wrap if necessary
           num = num – 26
        endif
        char = chr(num)         # convert back to character
        encryptedMessage = encryptedMessage + char
     else
        encryptedMessage = encryptedMessage + x
     endif
  next x
  return encryptedMessage
endfunction

# main program
shift = 3
msg = input(“Enter your message: ”)
encryptedMessage = encrypt(msg, shift)
print(“The encrypyted message is: ”, encryptedMessage)
```

Output is kl, mr!

(See Python program W2 Qu 1 Caesar cipher.py)

The purpose of the program is to encrypt text using the Caesar cipher. All uppercase letters are changed to lowercase. Non-alphabetic characters such as **space,** and **!** are not encrypted.

Task 2

2. An array `marks` is defined as follows: `marks[15, 18, 14, 9, 16, 12, 10]`

A pseudocode algorithm for an algorithm is given below.

```
items = len(marks)
for i = 0 to items - 2
   for j = 0 to (items - i - 2)
      if marks[j] > marks[j+1]
         temp = marks[j]
         marks[j] = marks[j+1]
         marks[j+1] = temp
      endif
   next j
next i
print (marks)
```

One pass is made through the outer loop of the algorithm.

Complete the trace table below to show how the contents of the array changes.

items	i	j	temp	marks						
				[0]	[1]	[2]	[3]	[4]	[5]	[6]
				15	18	14	9	16	12	10
7	0	0		15	**18**	14	9	16	12	10
		1		15	14	**18**	9	16	12	10
		2		15	14	9	**18**	16	12	10
		3		15	14	9	16	**18**	12	10
		4		15	14	9	16	12	**18**	10
		5		15	14	9	16	12	10	**18**

What is the name of the algorithm?

Bubble sort

(See Python program W2 Qu 2 bubble sort.py in folder)

3. Complete the trace table to determine the purpose of the following algorithm. Test it with input 11 and 5.

```
x = input ("Enter the first integer: ")
y = input ("Enter the second integer: ")
z = 0
while x > 0
   if x mod 2 == 1 then
      z = z + y
   endif
   x = x div 2
   y = y * 2
endwhile
print ("Answer =", z)
```

x	y	z	x > 0	x mod 2 == 1	output
11	5	0	True	True	
		5			
5	10				
		15			
2	20			False	
1	40			True	
		55			
0	80		False		Answer = 55

The purpose of the algorithm is to multiply two integers.
It is known as the “Russian peasant’s algorithm”. Students can look it up on the Internet to find out why it works!

The order that the columns are written in the trace table can make a difference to how easy is to fill in. Putting z before x and y would make a neater trace table. Students could experiment with this, using different numbers, e.g. 3 and 12.

See Python program W2 Qu 3 Russian peasants algorithm.py.

Get students to code the program and try it out with different integers.